

Title: QUILTING - Let's Finish the Pattern

Brief Overview:

This unit explores the mathematical explanations for patterns that repeat, tessellate, or transform to create designs used in various art forms, especially the American art of quilting.

NCTM 2000 Principles for School Mathematics:

- **Equity:** *Excellence in mathematics education requires equity - high expectations and strong support for all students.*
- **Curriculum:** *A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades.*
- **Teaching:** *Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.*
- **Learning:** *Students must learn mathematics with understanding, actively building new Knowledge from experience and prior knowledge.*
- **Assessment:** *Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.*
- **Technology:** *Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.*

Links to NCTM 2000 Standards:

- **Content Standards**

Number and Operations

Students will identify and continue number, geometric, and other sequences.

Algebra

Students will represent, analyze, and generalize a variety of patterns with tables.

Geometry

Students will observe polygons, identify the number of sides and the sums of the interior angles, and apply transformations to analyze mathematical situations.

Measurement

Students will find the measure of one angle of a regular polygon, use equilateral angles to show the meaning of "tessellation", and find the sum of the angles measured around a point.

- **Process Standards**

Mathematics as Problem Solving, Reasoning and Proof, Communication, Connections, and Representation

These five process standards are threads that integrate throughout the unit, although they may not be specifically addressed in the unit. They emphasize the need to help students develop the process that are the major means for doing mathematics, thinking about mathematics, understanding mathematics, and communicating mathematics.

Grade/Level:

Grades 5-8, General Mathematics and Geometry

Duration/Length:

This unit will take approximately seven mathematics class periods.

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Calculating by adding, subtracting, and multiplying whole numbers, decimals, and fractions
- Measuring angles to the nearest 10 degrees
- Rounding to the nearest hundredth
- Identifying the sum of the interior angles of a triangle is 180°
- Classifying and naming polygons by sides
- Listing factors of a number

Student Outcomes:

Students will:

- identify number, geometric and other patterns.
- use tessellation to make a pattern.
- use transformations to create a quilt block.
- make a paper quilt.

Materials/Resources/Printed Materials:

- A Cloak for the Dreamer by Aileen Friedman
- Pattern blocks
- Crackers in circle, square, and other polygonal shapes
- Protractors
- Pinned mirrors (optional)
- Teacher Resource Sheets
- Student Activity Sheets
- Large sheets of construction paper
- Scissors
- Paste/glue

Development/Procedures:

Day 1: "Patterns Galore" and "Literature Link"

In this unit we will be looking at patterns and discovering tessellations, shapes that cover a surface with no gaps.

- *Warm up:* Pass out Activity Sheet 1 and have the students find the next number in the sequence to complete the answers to numbers 1, 2, 3, 4, and 5. Review the answers with the class.
- Teacher reads *A Cloak for the Dreamer* by Aileen Friedman. While teacher is reading, students will try to cover a piece of paper with saltine crackers (square), Ritz Bits crackers (circle), and oyster crackers (octagon). Teacher directs students to look for patterns and problems.
- Teacher (using Activity Sheet #2) leads class discussion: Can you cover the paper with saltines? Can you cover the paper with Ritz crackers? What is the problem with covering the paper with circles? Which of the cloak shapes tessellate? Which does not? Same with the crackers. Which of the crackers tessellates? Which does not?
- Teacher directs class to examine the classroom around them. Are there any examples in the room where one shape covers an entire surface? Any that don't? (It may be helpful to plant a poster or maybe a speaker faceplate so that the students can see counter examples.)
- **Homework-** Describe a pattern you observe outside of school that covers an entire surface, just as we discovered in the book and in our classroom. Make a sketch and describe the shapes you observed.

Day 2: Finding Interior Angles by Deduction

- *Warm up:* Display a circle divided in quarters. Have the students name the angle measure of a right angle, a straight angle, and the whole circle. Review 360° in circle.
- Teacher passes out pattern blocks for each group of students.
- After students play with the blocks, teacher asks a series of guided questions, leading students to deduce the measurement of every angle on every block.
 1. On a piece of paper, draw a ray. Place a hexagon on the ray, with a vertex touching the endpoint. How many other hexagons can touch that endpoint at the same time? Point out that the 3 hexagons have gone around full circle. How many degrees does it take to get from one hexagon edge back around to the same edge? (360°). How many degrees is one angle of each of these hexagons? (120°)
 2. Use Activity Sheet 3 - Direct students to record the angle measurement on their recording sheet (**Interior Angle Measures**) for the hexagon. Direct students to stack triangles on the hexagons so that the triangles match the 120° angle of the hexagon. How many will fit? (2) How many degrees is the angle of each triangle? (60°)
Special Note: If students are experiencing frustration, direct them to begin with the equilateral triangle.
 3. By stacking blocks, find the angle measure of each angle in the shapes and have students record their answers on the pattern block shapes.
- **Homework-** Using Activity Sheet #4, students complete the table displaying each shape, the number of angles, and the measure of each angle.

Day 3: Mathematics of Tessellations

- *Warm up:* Review chart completed as homework. Ask students to share their observation of patterns. Examples include:
 1. all quadrilaterals have an angle sum of 360°
 2. the triangle has an angle sum of 180°
 3. the square's sum is twice that of the triangle.
 4. Ask if any student could predict the angle sum of a pentagon (5 sides). (540°) They should justify their answer.
 5. At the bottom of the homework chart, guide students to the algebraic expression for the sum of the interior angles (the structure of the chart should make this clear): $(n - 2)180$, where n is the number of sides in the polygon.
- Teacher passes out pattern blocks and Activity Sheet #5 for each group of students.
- Central Angles
 1. How many hexagons does it take to make a 360° central angle? (3) Trace the hexagons. What is the interior angle measure of a hexagon? (120°).
 2. Repeat these steps for the square and the triangle.

As students answer, record answers in a table so that the students can visualize the multiplication pattern in the answers.

| <u>Polygon</u> | <u># sides</u> | <u>angle measure</u> |
|---------------------------|----------------|----------------------|
| Hexagon | 6 | 120° |
| Square | 4 | 90° |
| Triangle (Equilateral) | 3 | 60° |

- Students should observe that the products are all 360° . Ask students to fill in this sentence: "3, 120, 4, 90, 6, 60 are all _____ of 360° ." (factors)
- Hand out the hinged mirrors and have students place the hexagon in the opening. How many hexagons do you see? (3) Repeat for the square (4) and the triangle (3). These are regular polygons. Are any of the other pattern blocks regular? (no).
- Ask students to predict whether a pentagon will tessellate. Justify the answers.
- Hand out a paper regular pentagon and place in the hinged mirror opening. What do you see? (Students should see a leftover portion in the reflection). This means it doesn't tessellate. What is happening? How can we calculate the leftover?
 $108^\circ + 108^\circ + 108^\circ + x^\circ = 360^\circ$
- If it is necessary, test a regular heptagon, octagon, or others with the algebraic equation and the hinged mirror.
(Note: if you do not have a hinged mirror set, provide students with at least four copies of each of the polygons you would like them to test for tessellation. They can cut them out and see if they overlap.)
- On the board refer to the chart listing the three regular tessellating pattern blocks. What do these polygons do that the pentagon (etc..) do not do? (tessellate) What rule can you derive to decide if a regular polygon will tessellate? (The measure of an angle must be a factor of 360° .) Which are the only regular polygons that work?

Day 4: Designing with Tessellations

- Tessellating other pattern blocks
Students come up with other combinations of pattern blocks. The object is to find other combinations of shapes that will add up to 360° .
- Use Activity 5
- Once students have a central angle of 360, ask them to tessellate a piece of paper using their pattern.

Day 5: Creating a Tessellated Quilt

- Provide students with an adequate number of paper pattern blocks.
- Use Activity 6
- Ask them to use yesterday's pattern activity to create a paper tessellated quilt that will tile a piece of 12" x 18" construction paper:

Performance Assessment:

For this learning unit the students have six (6) Activity Sheets using the rubric below. The two (2) assessment sheets need a separate rubric that is below.

Rubric For Activity Sheets

- | | |
|----------|--|
| 4 | Five items were selected. Students have written the next 3 numbers in sequential order and identified complete thoughts on all three brothers in the literature link. The patterns are 90% accurate. The student's work is neat. Extra credit will be awarded for the accurate completion for the challenge. |
| 3 | Five items were selected. Students have written the next 3 numbers in sequential order and identified complete thoughts on two of the three brothers in the literature link. The patterns are 80% accurate. The student's work is neat. Extra credit will be awarded for the accurate completion for the challenge. |
| 2 | Five items were selected. Students have written the next three numbers in sequential order and identified a complete thought on one of the brothers in the literature link. The patterns are 70% accurate. Extra credit will be awarded for the accurate completion for the challenge. |
| 1 | An effort has been made to do the assignment. Students have written the next three numbers in Numbers 1 and 2. Numbers 3-5 plus the challenge were not completed. |

Rubric for Assessment 1 Pattern Block Quilt

- **4 Points** Students were able to identify and name the geometric shapes used in tessellation to make a pattern, use transformation to create a quilt block and make a paper quilt with 90% accuracy.
- **3 Points** Students were able to identify and name the geometric shapes used in tessellation to make a pattern, use transformation to create a quilt block and make a paper quilt with 80% accuracy.
- **2 Points** Students were able to identify and name the geometric shapes used in tessellation to make a pattern, use transformation to create a quilt block and make a paper quilt with 70% accuracy.
- **1 Points** Students made an effort to identify and name the geometric shapes used in tessellation to make a pattern, use transformation to create a quilt block and make a paper quilt. None of the activities were completed.

Rubric for Assessment 2

- **4 Points** Students identified and named all the geometric shapes used in tessellation to make a pattern, the shapes that formed the central angle, identified tessellated or block type and were able to discover the mathematical connections necessary to complete the quilt.
- **3 Points** Students identified and named at least four of the geometric shapes used in tessellation to make a pattern, the shapes that formed the central angle, identified tessellated or block type and were able to discover the mathematical connections necessary to complete the quilt.
- **2 Points** Students identified and named at least three of the geometric shapes used in tessellation to make a pattern, the shapes that formed the central angle, identified tessellated or block type and were able to discover the mathematical connections necessary to complete the quilt.
- **1 Points** Students identified and named two of the geometric shapes used in tessellation to make a pattern, the shapes that formed the central angle, identified tessellated or block type and were able to discover the mathematical connections necessary to complete the quilt.

Extension/Follow Up:

Art is an obvious link to quilting by virtue of the design, color, and shapes used. The artistic concepts of positive and negative space, repeated or alternating patterns, and primary and secondary colors all have an application to this unit. A good reference book to use is *Sewing Quilts* by Ann Turner. It is a poetic example of influences in nature on quilting patterns.

Language Arts as a curriculum link to this unit on quilting is rich with stories, as our bibliography reflects. *The Quilt Maker's Gift* by Jeff Brumbeau and Gail de Marcken is an especially delightful tale of a rich king who wants an old woman, famous for her quilts, to make a quilt for him.

Reading this beautifully illustrated story to students not only reinforces the quilting theme of this unit, but also teaches character development. As the king pressures and even badgers the woman to make him a quilt, she holds fast to "her price". It is not until the king understands the joy of giving that his quilt from the old woman is complete.

Social Studies: This unit can be linked to the the Civil War era in American History. In the book, *Sweet Clara And The Freedom Quilt*, Clara makes a quilt by using information which she had received from perons who had traveled beyond the planatation. Other quilts were created by slaves based on information about different parts of plantations, villages, towns, and cities, and states. Farms and crops were on the quilts. Creeks, streams, and rivers were displayed on the quilts. The directions-north, south, east, and west were placed on the quilts. These quilts were helpful as maps by the people using the Underground Railroad. These passengers were able to use the information in quilts which were sometimes hung over fences as a guide in escaping to the North. Quilting like jazz music originated in the United States.

Authors:

Minnie Dyer
John Philip Sousa Middle School
Washington, District of Columbia

Dawn Martin-Brown
East Limestone High School
Athens, Alabama

Sister Rita A. Keller
St. Gregory the Great School
Virginia Beach, Virginia

Kimberly Morrow-Leong
All Saints Catholic School
Manassas, Virginia

TEACHER RESOURCE

INTRODUCTION TO LESSONS AND ACTIVITIES

"Quilting: Let's Finish the Pattern"

Quilting, like jazz music, is an art form with its origins in the United States. Surely the art of quilting was born of necessity. Old clothing was cut into small pieces, recycled and resewn into larger pieces. In this respect, quilting is a vivid example of the resourcefulness of the western pioneers and slaves.

Now, humans being humans, people were not content with simple squares stitched in a field. For example, an individual may cut a square in half and use the right triangles to cover the field. Creative quilters cut more intricate designs, incorporating the use of color contrast to give designs dimension. Today, there are three basic forms of quilting.

- Block quilts
- Tessellated quilts
- Free design quilts

The vast majority of traditional quilts were either block or tessellated quilts. Modern quilt artists, with greater access to a larger variety and larger pieces of fabric, have been able to take a home-based craft into the realm of art, suitable for museum display. This is not to assume that 19th century quilters did not create works of art. However, many quilts went unrecognized for their exceptional quality since the quilts were very well used and often destroyed. As quilting becomes recognized as a valid art form, textile artists are introducing quilters to free design quilts which incorporate other media, large, fluid pieces, and definitely freedom from the old square blocks.

In a block quilt, the stitcher worked one square piece of fabric at a time, and later stitched them all together into a whole cloth, often with strips separating each block. Many of the blocks have poetic names (such as *Drunkard's Path*, *Martha's Star*, *Whirligig*, *Freedom Star*...). Some of these blocks evolved as a means of communication between slaves on the Underground Railroad. Often quilts were hung on the lines to dry, but left much longer so that others could "read" about the map to freedom. (Please read *Sweet Clara and the Freedom Quilt* for a beautiful example)

While there is a great deal of geometry in the patchwork block quilts, tessellated quilts are the focus of our unit of study. A tessellated quilt usually consists of a single shape repeated throughout the whole quilt. The most basic of beginner quilts is made up of square patches sewn all together. The *square dance* pattern is all right triangles arranged into squares, using light and dark contrast to make a pattern. This unit uses pattern blocks, a common manipulative, with shapes designed for discovering geometry. Enjoy the connection to quilting!

Patterns Galore

Activity 1 Number Patterns

Directions: Find the next number in the sequences and patterns below:

1. 1, 3, _____, 7, _____, _____, 13

2. 26, 47, 68, 89, _____, _____, _____

3. $14\frac{1}{2}$, 29, $43\frac{1}{2}$, 58, _____, _____, _____

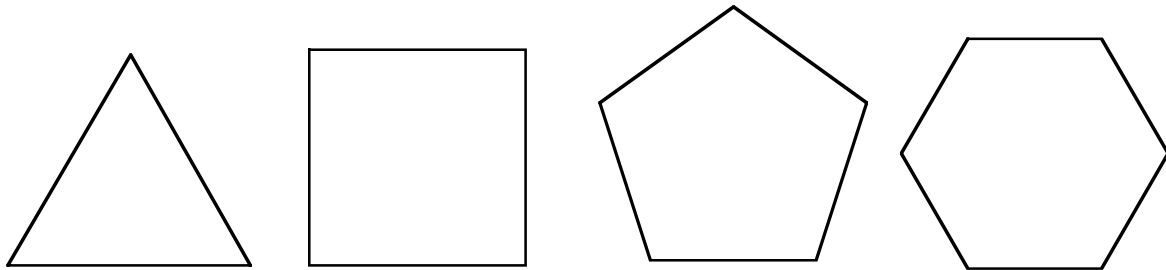
4. 0.35, 0.52, 0.69, 0.86, _____, _____, _____

Challenge:

49%, 19.6%, 7.84%, 3.136%, _____, _____, _____
round your answer to the nearest hundredth

Directions: Only one change is made between A and B. The same change is made between B and C, and between C and D. Describe it.

5. **A** **B** **C** **D**



Number Patterns

Answers For Activity 1

1. 5, 9, 11
2. Add 21 to the previous number : 110, 131, 152
3. Add 14 , 13 -- decrease **addend** by: 1 to 66 , 77, 86
4. Add 0.17 to the previous number 1.03, 1.2, 1.36

Challenge: Multiply the previous percent by 0.4

1.2544 % (1.25 %), 0.50176% (0.5%), 0.200704 % (0.2%)

5. Each figure has one more side than the prior one: triangle, square, pentagon, hexagon.

Literature Link

Activity 2 Patterns in Print

Teacher Reading: *A Cloak for the Dreamer* by Aileen Friedman and Kim Howard

Teacher directed discussion:

What geometric shape did the first brother's use in his design? **Answer:** rectangles

What geometric shape did the second brother's use in his design? **Answer:** triangles

What geometric shape did the third brother's use in his design? **Answer:** circles

Did all the shapes work as a repeating design pattern for the cloak?

Answer: rectangles and triangles - yes; circles - no

Use crackers -- Triangle Triscut, Wheat Thins, Club Crackers, Ritz Crackers, any other shapes you can find -- to illustrate these shapes and discover why some shapes worked and some did not.

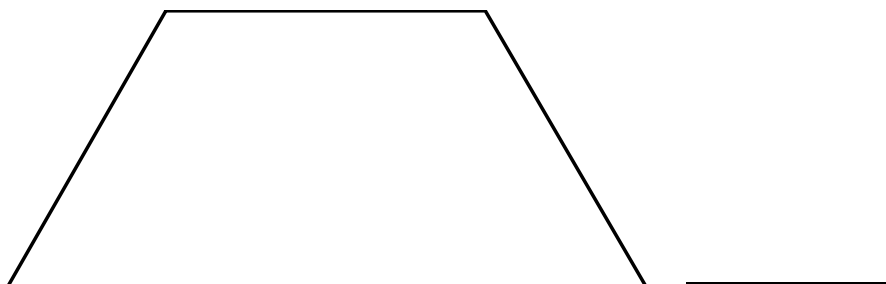
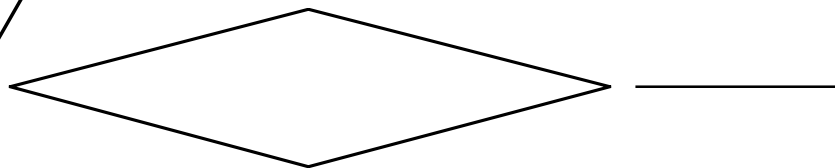
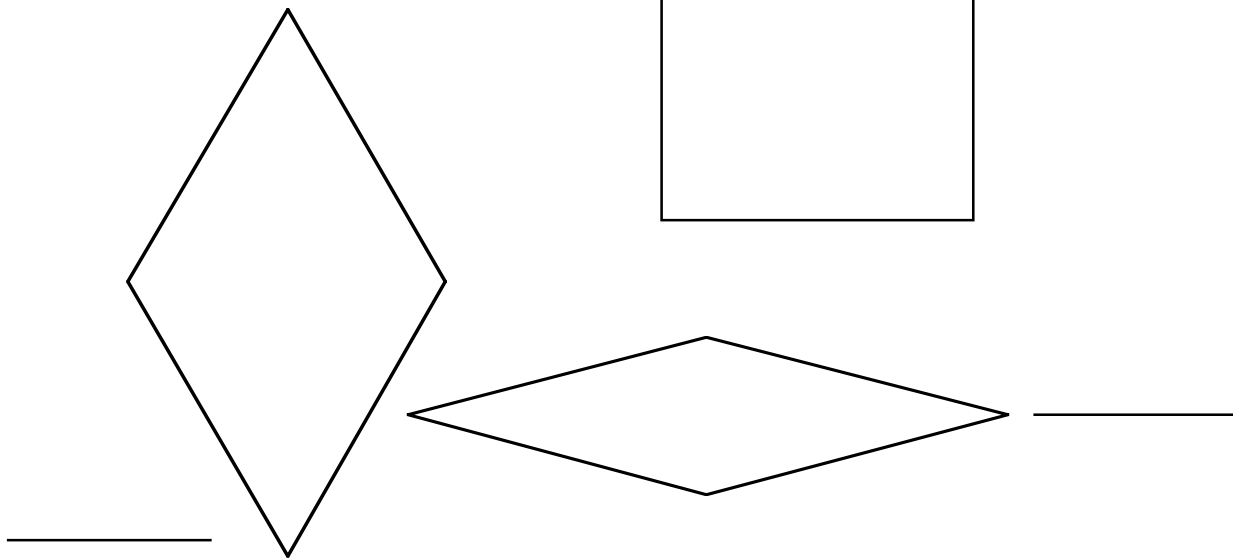
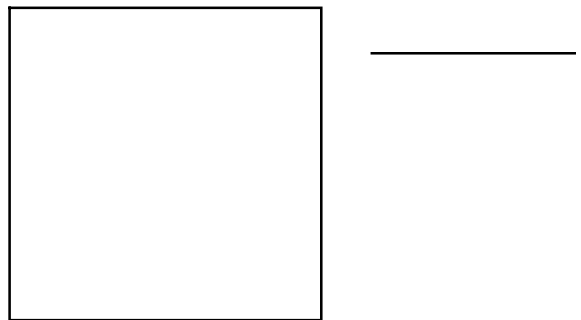
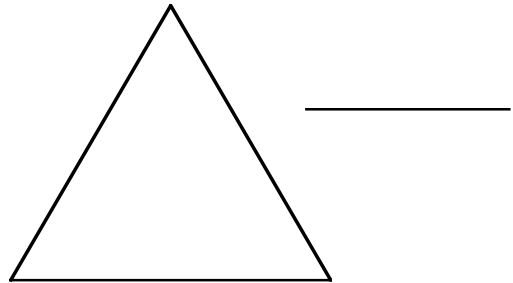
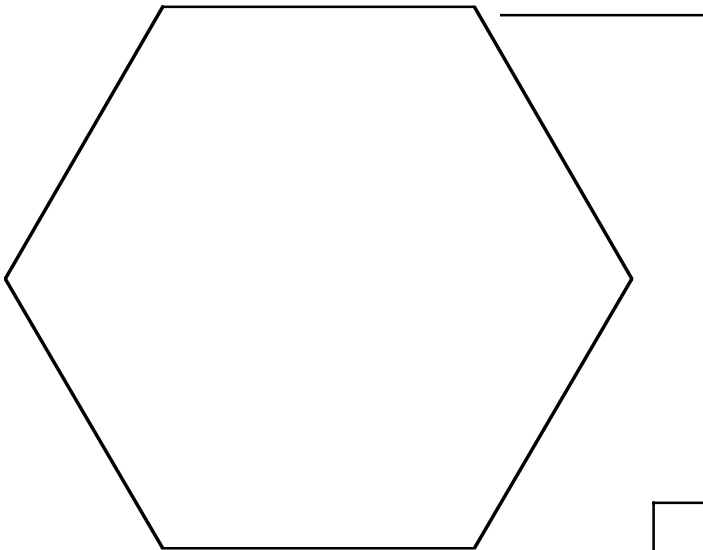
Challenge:

If the brothers collaborated, what other designs could they have used to make a cloak? **Answers will vary**

Interior Angle Measures of Pattern Blocks

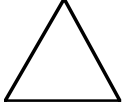
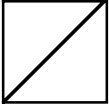
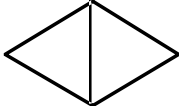
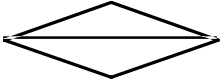

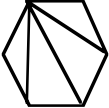
Activity Sheet 3

Directions: For each block, label the measure of each interior angle.
In the line next to the shape, label the sum of the interior angles.



Beginning Designs

Activity Sheet 4

| Shape | Name of Polygon | Number of Sides | Number of Triangles | Sum of Interior Angles |
|---|-----------------|-----------------|---------------------|------------------------|
|  | | | | |
|  | | | | |
|  | | | | |
|  | | | | |
|  | | | | |
|  | | | | |

Questions for reflection:

Which of these shapes is regular? Tell what makes them regular.

On the back, describe any patterns you see.

Tessellation Twists

Activity 5

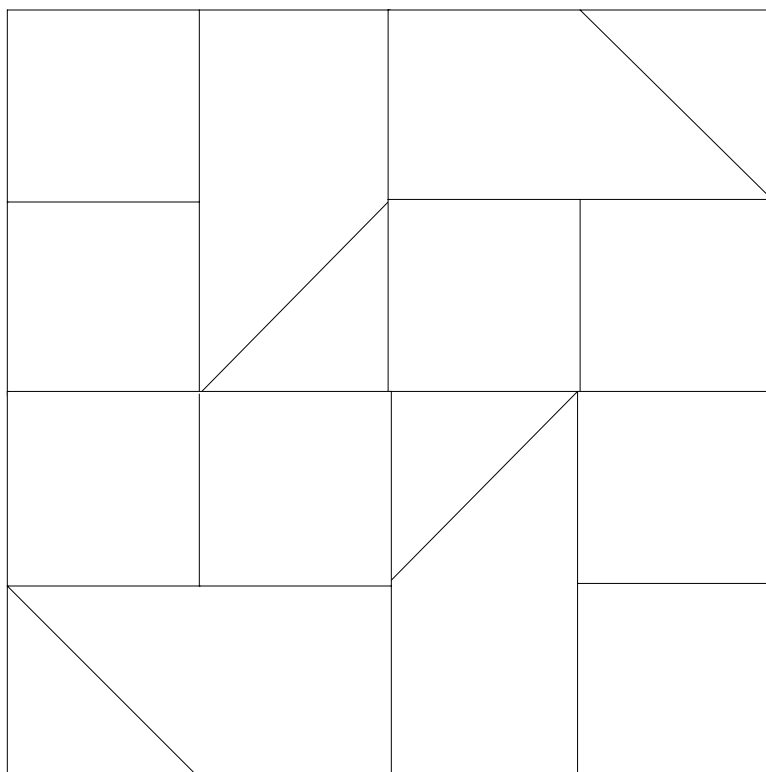
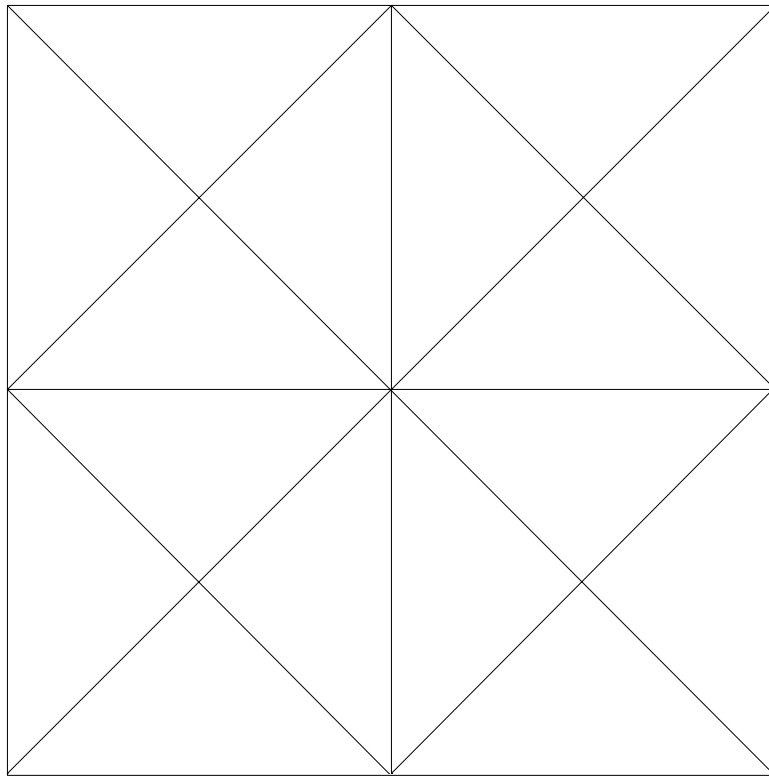
Directions: Work in groups. Use the hexagon, triangle, and square pattern blocks to create your design.

Sketch your design on this paper. Verify that the central angle in your tessellation is 360° .

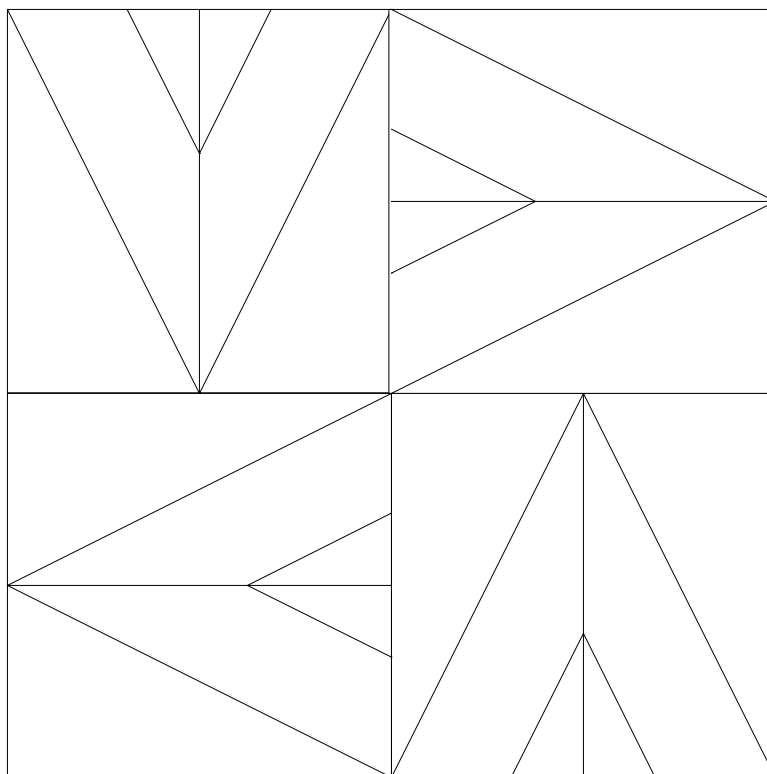
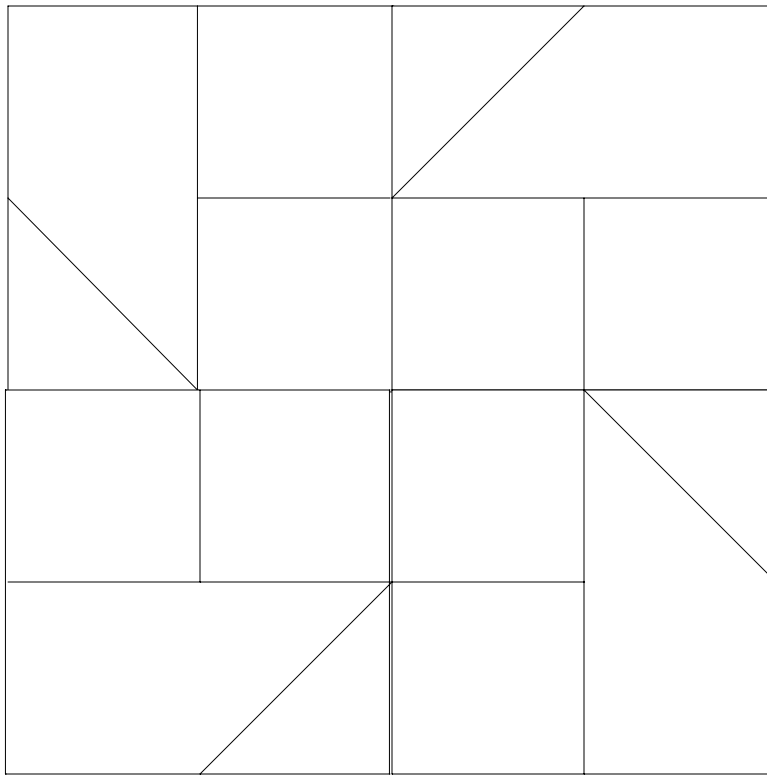
Designs to Die For

1. Have your group create an original tessellation design using pattern blocks.
2. Verify your 360° central angle tessellation design.
3. Paste your design below and challenge another group to check all central angle measurements.

**Transformation Pattern Sample 1
for Activity 6**



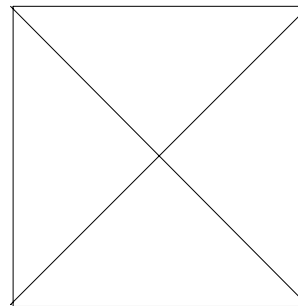
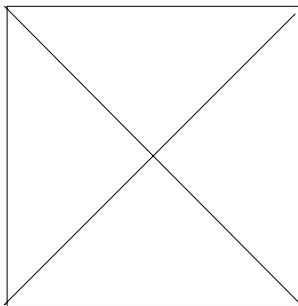
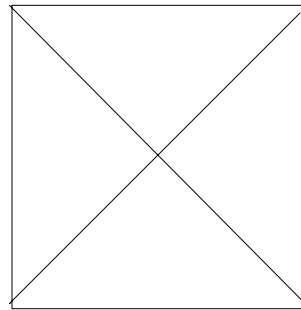
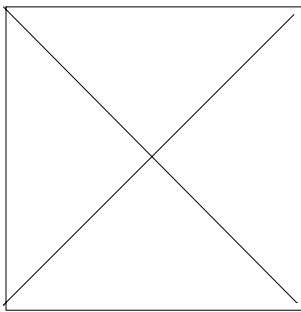
**Transformation Pattern Sample 2
for Activity 6**



FLIP FLOP TURN AROUND

Activity 6

Directions:



Creating a Tessellated Quilt

Activity 6

Directions:

1. Create an original quilt design using pattern blocks with construction paper
2. Identify all geometric shapes
3. Identify all angle measures

4. What are some of the problems you dicovered while making your design,and how did you resolve them?

How Did your Quilting Measure Up?

Tell Us About Your Quilt:

1. What geometric shapes did you use? _____

2. What shape(s) forms the central angle(s) of your pattern?

3. What type of quilt did you make: Tessellated _____
Block _____

4. What mathematical connections did you discover that were necessary to complete your quilt?

QUILTING - Let's Finish the Pattern

Bibliography

Beyer, Jinny. Designing Tessellations: the Secrets of Interlocking Patterns.

Contemporary Books, 1999. ISBN #0-8092-2866-1.

This book's intended audience is quilters, however, it is clear that Jinny Beyer spent considerable time and effort investigating the mathematics behind tessellations. It is legible enough for lay readers, but with solid math underneath.

Friedman, Aileen; illustrated by Kim Howard; A Cloak for the Dreamer.

Scholastic Trade, 1995. ISBN# 0590489879.

Hopkinson, Deborah. Sweet Clara and the Freedom Quilt. Alfred A. Knopf, 1993.

ISBN #0-679-82311-5 and #0-679-92311-X. *Clara is a young slave girl who stitches a map that guides escaping slaves through the Underground Railroad to Canada.*

Additional Sources

Atkins, Jeannine. The Name on the Quilt. Atheneum, 1999. ISBN # 0689815921.

This book is the story of a family creating a memorial quilt for a relative who has died of AIDS. This subject is brought up subtly near the end.

Brackman, Barbara. Encyclopedia of Pieced Quilted Patterns. American Quilter's Society, 1993.

ISBN #0-89145-815-8. *If you can't find a quilt pattern in this book of 4,000 quilt blocks, you aren't looking hard enough. Black and white sketches of well-organized lists of quilt designs provide a wealth of ideas on all types of pieced quilts.*

Britton, Jill. Symmetry and Tessellations. Dale Seymour Publications, 1999.

ISBN # 0769000835. *Lessons and ideas for math teachers, grades (5 – 8).*

Brumbeau, Jeff. The Quiltmaker's Gift. Scholastic Press, 2000. ISBN #0-439-30910-7.

A greedy king desires the one thing that he can not get. The quiltmaker refuses to give the king a quilt until he gives all of his belongings away. The king learns the joy he can give others through the act of giving and eventually earns his own quilt. The illustrations are stunning and the author documents each of the quilt patterns used in the book. A companion volume is an instructional book for quilters to make the patterns in the book.

Buchberg, Wendy. Quilting Activities Across the Curriculum. Scholastic, Inc., 1996.

ISBN #0-590-96558-1. *The audience for this book is teachers of K - 3. Some of the projects and the blackline masters can be used for older grades for age appropriate activities.*

Cobb, Mary. The Quilt-Block History of Pioneer Days – With Projects Kids can Make.

Millbook Press Trade, 1995. ISBN #1562946927.

Cohen, Luanne S. Quilt Design Masters. Dale Seymour Publications, 1995. ISBN # 0866519416.

DeCordova, Chris. The Tessellations File. Parkwest Publishing, 1986. ISBN #09062212359.

Ernst, Lisa Campbell. Sam Johnson and the Blue Ribbon Quilt. Mulberry Books, 1992.
ISBN # 0688115055.

Flournoy, Valerie. The Patchwork Quilt.

Franco, Betsy. Grandpa's Quilt.

Guback, Georgia. Luka's Quilt. Greenwillow, 1994. ISBN #0688121543.

Howard, Ellen. The Log Cabin Quilt. Holiday House, 1997. ISBN # 0823413365.

Johnston, Tony. The Quilt Story (Paperstar). Paperstar, 1996. ISBN #0698113683.

Jonas, Ann. The Quilt. Puffin, 1994. ISBN #0140553088.

Kinsey-Warnock, Natalie. The Canada Geese Quilt. Yearling, 1992. ISBN #0440407192.

Kurtz, Shirley. The Boy and the Quilt. Good Books, Intercourse, PA, 1991.
ISBN #1-56148-009-6. *A mother and her son collaborate and create a cherished quilt of square scraps of fabric.*

Love, D. Anne. Bess's Log Cabin Quilt. Yearling, 1996. ISBN # 0440411971.

Moss, P. Buckley. Reuben and the Quilt. Good Books, 1999. ISBN # 156148234X.

Nichols, Margaret H. Perfect Patchwork. Sterling Publishing Co., 1993. ISBN #0-8069-0358-9.
This is a quilter's book that illustrates some very traditional rotational quilt blocks.

Parton, Dolly. Coat of Many Colors. Scholastic, 1994. ISBN #0-590-89935-X.
Yes, written by that Dolly Parton, the Coat of Many Colors is the story of a coat made for Dolly by her mother out of scraps of cloth from others' old clothing. At first the other children begin to mock her, but soon they recognize some of their own cherished items in the patches of the coat. Capturing the spirit and history of quilting, the pieced coat is this poor family's only source of warmth.

Paul, Ann Whitford. Eight Hands Round: A Patchwork Alphabet. Harper Trophy, 1996.
ISBN # 0064434648. *An alphabet book with a traditional quilt block with each letter.*

Polacco, Patricia The Keeping Quilt. Aladdin Paperbacks, 2001. ISBN # 0689844476.

Ransom, Candice. The Promise Quilt. Walker & Co., 1999. ISBN # 0802786944.

Ryan, Celeste. The Dream Quilt. Waterbrook Press, 1999. ISBN #1578562236.

Seymour, Dale. Tessellation Teaching Masters. Dale Seymour Publications, 1999.
ISBN # 0866514627.

Seymour, Dale. Tessellation Winners : Escher-Like Original Student Art: The First Contest.
Dale Seymour Publications, ISBN # 0866515488.

Seymour, Dale. Introduction to Tessellations. Dale Seymour Publications, ISBN # 0866514619.

A fantastic book if you aren't quite sure why tessellations work and what the math is behind them. The explanations and designs are clear and easy to follow.

Smucker, Barbara. Selina and the Bear Paw Quilt. Dragon Flyer Press, 1999. ISBN #0517885786.

Soltys, Karen Costello. One Patch. The Classic American Quilt Collection. Rodale Press, 1995.

ISBN #0-87596-684-5. *As the title implies, this book is a quilter's manual for creating designs using only one patch. This is essentially the single polygons that tessellate. Some of the designs are partitioned, but essentially each is a one shape tessellation.*

TesselMania!, computer software.

Turner, Ann. Sewing Quilts. Macmillan Publishing, 1994. ISBN #0-02-789285-9.

Written in verse, this book is a poetic exploration of the influences of nature and environment in the color choices in quilting.

Vaughn, Marcia, The Secret to Freedom.

Venters, Diana and Elaine Krajenke Ellison . Mathematical Quilts-No Sewing Required.

Key Curriculum Press, 1999. ISBN #1-55953-317-X. *The author of this book is creating works of quilting art based mostly on high school level mathematics. Some do have middle school applications: the Golden Rectangle, the Fibonacci Sequence, the Pythagorean triangle, and tessellations.*

Waterstone, Rachel. The Much Too Loved Quilt. First Story Press, 1999. ISBN # 1890326151.

Willing, Karen Bates and Julie Bates Dock. Quilting Now & Then.

Now & Then Publications, 1994. ISBN #0-9641820-0-9 and pbk. ISBN #0-9641820-1-7.

This book is a good representation of quilting today. Many of the fabric combinations are modern in color, and this artist buys her fabric new, unlike the pioneers of quilting!